

In The Claims

This listing of all claims will replace all prior versions, and listings, of claims in the application:

1. ~~(currently amended)~~ An integrated paper having active particles immobilized therein, said integrated paper comprising of:

a plurality of fibrillated fibers immobilized within said integrated paper, said fibers fibrillated at a temperature greater than about 30°C, wherein said fibrillated fibers have an average fiber diameter of less than about 1000 nm;

active agents immobilized within said integrated paper wherein the average diameter of said fibrillated fibers is less than an average particle size of said active agents to physically entrap said active agents within said integrated paper, said active agents selected from the group consisting of metals, metal salts, metal oxides, alumina, carbon, activated carbon, silicates, ceramics, zeolites, diatomaceous earth, activated bauxite, fuller's earth, calcium sulfate, titanium dioxide, magnesia, magnesium hydroxide, magnesium oxide, manganese oxides, iron oxides, perlite, talc, clay, bone char, calcium hydroxide, calcium salts, or combinations thereof;

binder fibers or particles; and

a microbiological interception enhancing agent on at least a portion of at least some of said fibrillated fibers ~~and/or~~ and said active agents immobilized within said integrated paper, such that, said microbiological interception enhancing agent is also immobilized within and resides throughout the entire thickness of said integrated paper, said microbiological interception enhancing agent comprising a biologically active metal precipitated with a counter ion of a cationic material that is residing on said at least portion of said

21 fibrillated fibers ~~and/or~~ and said active agents that are residing within and throughout the
22 entire thickness of said integrated paper to form a colloidal metal precipitate within and
23 throughout said integrated paper that are on a surface of said at least portion of said
24 fibrillated fibers and/or said active agents,
25 wherein said integrated paper has a mean pore size of less than or equal to about 2 microns and
26 said fibrillated fibers and said active agents have different settling velocities such that said
27 integrated paper has an asymmetric structure when formed by wet-laid processes.

1 2. (Original) An integrated paper of claim 1 wherein said fibrillated fibers comprise
2 Lyocell.

1 3. (Previously presented) An integrated paper of claim 2 wherein the lyocell has an
2 average fiber diameter of less than about 400 nm.

1 4. (Previously presented) An integrated paper of claim 1 wherein said active agents have
2 an average particle size of less than or equal to about 1 micron to about 5000 microns.

1 5.-8. (Cancelled)

1 9. (Previously presented) The integrated paper of claim 1 wherein said fibrillated fibers
2 have an average fiber diameter of less than about 400 nm; and
3 said active agents further being selected from silver oxide particles admixed with said fibrillated
4 fibers.

1 10. (Original) An integrated paper of claim 9 wherein the fibrillated fibers comprise a
2 liquid crystal polymer.

1 11. (Previously presented) The integrated paper of claim 1 wherein said fibrillated fibers
2 have an average fiber diameter of less than about 400 nm; and
3 said active agents further being selected from one or more acid neutralizing agents admixed
4 with said fibrillated fibers;
5 wherein said integrated paper can withstand a hot and corrosive environment of a lube oil filter,
6 and wherein said one or more acid neutralizing agents comprises magnesium oxide, magnesium
7 hydroxide, calcium sulfonate, magnesium sulfonate, calcium phenate, magnesium phenate, or
8 combinations thereof.

1 12. (Original) An integrated paper of claim 11 further including binder fibers or particles.

1 13. (Cancelled)

1 14. (currently amended) An integrated paper comprising of:
2 a plurality of lyocell fibers immobilized within and throughout said integrated paper, said
3 lyocell fibers fibrillated at a temperature greater than about 30°C, wherein said
4 fibrillated lyocell fibers have an average fiber diameter of less than or equal to about 400
5 nm;

6 activated carbon particles admixed with said fibrillated lyocell fibers and immobilized
7 within and throughout said integrated paper, wherein the average diameter of said
8 lyocell fibers is less than an average particle size of said active agents to physically
9 entrap said active agents within said integrated paper, -said integrated paper has a mean
10 flow path of less than about 2 microns;

11 binder fibers or particles; and

12 a microbiological interception enhancing agent on at least a portion of at least some of said
13 fibrillated lyocell fibers immobilized within said integrated paper, such that, said
14 microbiological interception enhancing agent is also immobilized within and resides
15 throughout said integrated paper, said microbiological interception enhancing agent
16 comprising a biologically active metal precipitated with a counter ion of a cationic
17 material that is residing within and throughout said integrated paper and on said at least
18 portion of said fibrillated lyocell fibers to form a colloidal metal precipitate within and
19 throughout said integrated paper and on a surface of said at least portion of said
20 fibrillated lyocell fibers.

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1 15. (Cancelled)

1 16. (Original) An integrated paper of claim 14 further including a heavy metal reducing
2 agent.

1 17. (Previously presented) An integrated paper of claim 16 wherein the heavy metal
2 reducing agent comprises particles of zeolite, silicate, or combinations thereof.

1 18. Original) An integrated paper of claim 14 further including an arsenic reducing agent.

1 19. (Original) An integrated paper of claim 18 wherein the arsenic reducing agent
2 comprises particles of iron, oxides of manganese or iron, or combinations thereof.

1 20. (currently amended) An integrated paper comprising:
2 a plurality of fibrillated fibers having an average fiber diameter of less than about 1000 nm
3 immobilized within said integrated paper;
4 active agents immobilized within said integrated paper and admixed with said plurality of
5 fibrillated fibers, wherein the average diameter of said fibrillated fibers is less than an
6 average particle size of said active agents to physically entrap said active agents within
7 said integrated paper; and
8 a microbiological interception enhancing agent on at least a portion of at least some of said
9 fibrillated fibers ~~and/or~~ said active agents, said microbiological interception enhancing
10 agent comprising a biologically active metal precipitated with a counter ion of a cationic
11 material that is residing on said at least portion of said fibrillated fibers ~~and/or~~ said
12 active agents to form a colloidal metal precipitate on surfaces thereof, whereby said
13 microbiological interception enhancing agent is immobilized within and resides
14 throughout said integrated paper since prior to forming said integrated paper using said
15 fibrillated fibers ~~and/or~~ said active agents, said fibrillated fibers ~~and/or~~ said active
16 agents are treated with said microbiological interception enhancing agent,
17 wherein said integrated paper has a mean flow path of less than about 2 microns.

1 21-41. (Cancelled)

1 42. (Previously presented) The integrated paper of claim 1 wherein said colloidal metal
2 precipitate includes a silver-amine-halide complex.

1 43. (Previously presented) The integrated paper of claim 1 wherein said fibrillated fibers
2 have an average diameter of less than or equal to 250 nm and a length of 1mm to about 8 mm.

1 44. (Previously presented) The integrated paper of claim 1 wherein said colloidal metal
2 precipitate is physically trapped within a matrix of said cationic material.

1 45. (Previously presented) The integrated paper of claim 1 wherein said colloidal metal
2 precipitate is bound to said cationic material.

1 46. (Previously presented) The integrated paper of claim 45 wherein said colloidal metal
2 precipitate is bound to said cationic material by adsorption.

1 47. (Previously presented) The integrated paper of claim 45 wherein said colloidal metal
2 precipitate is bound to said cationic material by electrostatic forces.

1 48. (new) An integrated paper having active particles immobilized therein, said integrated
2 paper comprising of:

active agents physically entrapped within said integrated paper, said active agents residing within and throughout the entire thickness of said integrated paper;

a plurality of fibrillated fibers hydroentangled within said integrated paper, said fibrillated fibers having an average fiber diameter less than an average particle size of said active agents for the physical entrapment of said active agents within said integrated paper, said fibrillated fibers residing within and throughout the entire thickness of said integrated paper; and

a microbiological interception enhancing agent at least on a portion of some of said active agents and as such is also physically entrapped within said integrated paper by said plurality of fibrillated fibers, said microbiological interception enhancing agent comprising a biologically active metal precipitated with a counter ion of a cationic material residing on said portion of some of said active agents to form a colloidal metal precipitate residing within and throughout the entire thickness of said integrated paper.

49. (new) The integrated paper of claim 48 further including additional of said microbiological interception enhancing agent on a portion of some of said fibrillated fibers, said microbiological interception enhancing agent comprising said biologically active metal precipitated with a counter ion of a cationic material residing on said portion of some of said fibrillated fibers to form said colloidal metal precipitate residing within and throughout the entire thickness of said integrated paper, whereby both some of said active agents and some of said fibrillated fibers have said microbiological interception enhancing agent.

1 50. (new) The integrated paper of claim 48 wherein said fibrillated fibers and said active
2 agents have different settling velocities such that said fibrillated fibers settle to one surface of
3 the integrated paper and the active agents settle to the other surface of the integrated paper so
4 that an asymmetric pore gradient exists through the thickness of the integrated paper.

1 51. (new) The integrated paper of claim 50 wherein said asymmetric pore gradient provides
2 an integrated paper having a pore structure from a prefiltration structure to a final polishing
3 filter.

1 52. (new) The integrated paper of claim 48 further including binder fibers or particles
2 having an average diameter equal to or less than the average particle size of the active agents to
3 physically entrap the active agents within the integrated paper.

1 53. (new) The integrated paper of claim 48 wherein said fibrillated fibers have an average
2 diameter of less than or equal to 250 nm.

1 54. (new) The integrated paper of claim 48 wherein the active agents are present in an
2 amount of up to about 50 weight percent based on a total weight of the integrated paper.

1 55. (new) The integrated paper of claim 54 wherein the active agents are present in an
2 amount of up to about 75 weight percent based on the total weight of the integrated paper.

1 56. (new) The integrated paper of claim 48 wherein said integrated paper has a mean pore
2 size of less than or equal to about 1 micron to provide supplemental direct mechanical
3 interception of microbiological contaminants in combination with the microbiological
4 interception enhancing agent.

1 57. (new) The integrated paper of claim 56 wherein said mean pore size is less than or equal
2 to about 0.5 microns to provide the supplemental direct mechanical interception of
3 microbiological contaminants.

1 58. (new) An integrated paper having active particles immobilized therein, said integrated
2 paper comprising of:

3 active agents physically entrapped within said integrated paper, said active agents residing
4 within and throughout the entire thickness of said integrated paper;

5 a plurality of fibrillated fibers hydroentangled within said integrated paper, said fibrillated
6 fibers having an average fiber diameter less than an average particle size of said active
7 agents for the physical entrapment of said active agents within said integrated paper,
8 said fibrillated fibers residing within and throughout the entire thickness of said
9 integrated paper; and

10 a microbiological interception enhancing agent at least on a portion of some of said
11 hydroentangled fibrillated fibers, said microbiological interception enhancing agent
12 comprising a biologically active metal precipitated with a counter ion of a cationic
13 material residing on said portion of some of said fibrillated fibers to form a colloidal

14 metal precipitate residing within and throughout the entire thickness of said integrated
15 paper.

1 59. (new) The integrated paper of claim 58 further including additional of said
2 microbiological interception enhancing agent on a portion of some of said active agents and
3 also being physically entrapped within said integrated paper by said plurality of fibrillated
4 fibers.

1 60. (new) The integrated paper of claim 58 wherein said fibrillated fibers and said active
2 agents have different settling velocities such that said fibrillated fibers settle to one surface of
3 the integrated paper and the active agents settle to the other surface of the integrated paper so
4 that an asymmetric pore gradient exists through the thickness of the integrated paper.

1 61. (new) The integrated paper of claim 60 wherein said asymmetric pore gradient provides
2 an integrated paper having a pore structure from a prefiltration structure to a final polishing
3 filter.

1 62. (new) The integrated paper of claim 58 further including binder fibers or particles
2 having an average diameter equal to or less than the average particle size of the active agents to
3 physically entrap the active agents within the integrated paper.

1 63. (new) The integrated paper of claim 58 wherein said fibrillated fibers have an average
2 diameter of less than or equal to 250 nm.

1 64. (new) The integrated paper of claim 58 wherein the active agents are present in an
2 amount of up to about 50 weight percent based on a total weight of the integrated paper.

1 65. (new) The integrated paper of claim 58 wherein said integrated paper has a mean pore
2 size of less than or equal to about 1 micron to provide supplemental direct mechanical
3 interception of microbiological contaminants in combination with the microbiological
4 interception enhancing agent.

1 66. (new) An integrated paper having active particles immobilized therein, said integrated
2 paper comprising of:

3 active agents physically entrapped within said integrated paper, said active agents residing
4 within and throughout the entire thickness of said integrated paper;

5 a plurality of fibrillated fibers hydroentangled within said integrated paper, said fibrillated
6 fibers having an average fiber diameter less than an average particle size of said active
7 agents for the physical entrapment of said active agents within said integrated paper,
8 said fibrillated fibers residing within and throughout the entire thickness of said
9 integrated paper; and

10 a microbiological interception enhancing agent on a portion of some of said active agents
11 and as such also being physically entrapped within said integrated paper by said
12 plurality of fibrillated fibers and on a portion of some of said hydroentangled fibrillated
13 fibers, said microbiological interception enhancing agent comprising a biologically
14 active metal precipitated with a counter ion of a cationic material residing on said

15 portion of some of said active agents and said fibrillated fibers to form a colloidal metal
16 precipitate residing within and throughout the entire thickness of said integrated paper.

1 67. (new) The integrated paper of claim 66 wherein said fibrillated fibers and said active
2 agents have different settling velocities such that said fibrillated fibers settle to one surface of
3 the integrated paper and the active agents settle to the other surface of the integrated paper so
4 that an asymmetric pore gradient exists through the thickness of the integrated paper.

1 68. (new) The integrated paper of claim 67 wherein said asymmetric pore gradient provides
2 an integrated paper having a pore structure from a prefiltration structure to a final polishing
3 filter.

1 69. (new) The integrated paper of claim 66 further including binder fibers or particles
2 having an average diameter equal to or less than the average particle size of the active agents to
3 physically entrap the active agents within the integrated paper.

1 70. (new) The integrated paper of claim 66 wherein said fibrillated fibers have an average
2 diameter of less than or equal to 250 nm.

1 71. (new) The integrated paper of claim 66 wherein the active agents are present in an
2 amount of up to about 50 weight percent based on a total weight of the integrated paper.

1 72. (new) The integrated paper of claim 66 wherein said integrated paper has a mean pore
2 size of less than or equal to about 1 micron to provide supplemental direct mechanical
3 interception of microbiological contaminants in combination with the microbiological
4 interception enhancing agent.